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COMPLETE SPECIFICATION

A process for the Hydrogenation of Carbon Monoxide

We, RHEINPREUSSEN AKTIENGESELLSCHAFT FUER BERGBAU UND CHEMIE, of Homberg/Niederrhein, Germany, a German Joint Stock Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a process for the synthesis of hydrocarbons by the hydrogenation of carbon monoxide in the presence of an iron catalyst at normal or substantially atmospheric pressure.

It is known that the hydrogenation of carbon monoxide in the presence of iron catalysts is more difficult to effect at normal pressure than at elevated pressure. The cause or causes of such difficulty or difficulties have not, however, hitherto been discovered.

It has now been found that the extent of the conversion of carbon monoxide and the life of the iron catalyst are considerably influenced by the water vapour content of the gases entering the reactor, that is to say, by the partial pressure of water vapour in the fresh synthesis gases, as well as by the partial pressure of water vapour in the recycle gas when the synthesis gases are recycled or, when the hydrogenation of carbon monoxide is effected in several stages, by the partial pressure of water vapour in the exit gases which are passed from one synthesis stage to the next synthesis stage.

According to the invention, the synthesis gas fed into the reactor in a process for the hydrogenation of carbon monoxide effected at or about atmospheric pressure in the presence of an iron catalyst, is dried until its water vapour content is less than 30 grams per cubic metre of the synthesis gas. Thus the synthesis gas is dried to reduce its water vapour content to a quantity which is insufficient to saturate the gas at a temperature of 30° C.

The synthesis gas fed into the reactor may be fresh gas, recycle gas, a mixture of fresh gas and recycle gas or, in multi-stage operation, it may be the exit gas from one stage which is passed as feed gas into a subsequent stage.

The drier the synthetic gas, the more pronounced is the effect obtained by the process according to the invention. Thus when, in one example of carrying the invention into effect, a synthesis gas having a water vapour content just sufficient to saturate the gas at 18° C. (15.4 grams of water vapour per cubic metre of synthesis gas) was contacted with a precipitated iron catalyst (100 parts by weight of iron, 65 parts by weight of sintered dolomite, 7.5 parts by weight of copper, 2 parts by weight of potassium carbonate) which had not been reduced prior to use in the synthesis, the carbon monoxide conversion attained, at a temperature of 225° C., a maximum of 40% after 130 hours of operation. The synthesis gas consisted of 1 volume of fresh gas (containing hydrogen and carbon monoxide in the ratio 1.7:1) and 3 volumes of recycle gas, and it was contacted with the catalyst at the rate of 48 litres (12 litres of fresh gas plus 36 litres of recycle gas) per hour per 10 grams of iron contained in the catalyst mass. When the synthesis gas was dried to a still greater extent, the fresh gas being dried by means of calcium chloride and the water vapour in the recycle gas being fixed or removed by activated carbon, the carbon monoxide conversion, with the other reaction conditions remaining the same, attained a maximum of 80% after about 40 hours of operation.

It is preferred to use, in the process according to the invention, a synthesis gas in which the water vapour content is within the range 4—15 grams per cubic metre of the gas.

The effect of drying the gas also becomes more pronounced the greater the proportion of hydrogen in the synthesis gas which is reacted in the presence of the iron catalyst.

The temperature of the synthesis, the composition of suitable iron catalysts, the ratios of hydrogen to carbon monoxide in the feed gas, the gas throughput and other similar

synthesis conditions are well known in the production of hydrocarbons by the hydrogenation of carbon monoxide at or about atmospheric pressure.

What we claim is:—

1. A process for the synthesis of hydrocarbons by the hydrogenation of carbon monoxide at normal pressure in the presence of an iron catalyst, in which the synthesis gas fed into the reactor is dried until its water vapour content is less than 30 grams per cubic metre of the gas.

2. A process according to claim 1, in which the water vapour content of the synthesis gas is within the range 4—15 grams per cubic metre of the gas.

3. A process for the hydrogenation of carbon monoxide, substantially as hereinbefore described.

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